Washington State
Department of Transportation

Cross-Cascades Corridor Analysis Project

Summary Report

2001

Cross-Cascasdes Corridor Analysis Project User Guide

Preface

The Cross-Cascades Corridor model provides a unique tool for forecasting transportation demand and understanding how our transportation systems and the economy interact. Begun as a modeling effort of the Seattle to Spokane corridor, the project has become the basis for a new approach to corridor and statewide modeling across the state. This report framework documents the effort and outlines key considerations for future model development. There are three separate documents contained in this framework that summarize and describe the modeling effort developed as part of the Cross-Cascades Corridor Analysis Project.

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These documents and supporting material require the use of Adobe Acrobat software to read and access other files via the navigation bar located on each page, in either the left or right hand side margin.

Each of these reports is explained in greater detail below. You can navigate inside the Summary Report, Model Documentation, or User Guide using the table of contents elements or the page up and down arrows. You can also enter another document by clicking on the document name at the bottom of the navigation bar. If you would like to exit the document framework altogether or return to the cover page, use the report cover icon at the bottom of the page.

Summary Report

The Summary Report provides an overview of the purpose of the project and a general description of the Cross-Cascades Corridor. The report also serves as an introduction to the model, it's structure, how it represents the corridor, the model components, how it was tested, and a demonstration of how the model estimates the effects of different events or policy decision scenarios on the corridor. Suggestions for future modeling efforts are also offered in this section.

The Summary Report has also been produced in a print-friendly format. Material contained in the printed report is the same as that shown here. To receive copies of the printed version of the document, visit the project web site at http://www.wsdot.wa.gov/ppsc/cascadesx/Cross%20Cascades%20Corridor%20Analysis%20Web/index.htm, or contact WSDOT's Transportation Planning Office by mail at Transportation Building, PO Box 47370, Olympia, WA 98504-7370, or by telephone at (360) 705-7958.

Model Documentation

The Model Documentation report provides greater deal about the inner-workings and inputs to each of the Cross-Cascades Corridor model's components - the Land Use Model, Transport Model, and Interface Model. Calibration or testing methods used during the model development effort, and the scenarios used to demonstrate the model's potential, are also described in greater detail. In some cases, topics covered in the Model Documentation report are supported with another, more detailed page that is often accompanied by an explanatory spreadsheet or example of model output. A site map for this document is available in the navigation bar on each page.

User Guide

The User Guide is designed to support the user when installing and running the MEPLAN model. This report covers the model's basic structure and the critical files that were used in its development. This document also discusses the ArcView interface and the model development project references.

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Washington State Department of Transportation

Cross-Cascades Corridor Analysis Project

WSDOT - Transportation Planning Office

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User Guide

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Setting Up MEPLAN

This guide is intended to support a user in running the MEPLAN model, as applied in the WSDOT Cross Cascades Corridor Analysis Project. MEPLAN is developed by ME&P and was purchased by WSDOT for the Cross-Cascades Corridor Analysis Project. This guide is a summary of pertinent information pulled from the MEPLAN User's Reference Manual [UG1] as it applies to this project, as well as other project-specific context. The reader should access the more detailed MEPLAN User's Reference Manual for additional reference on file formats, error messages, and program operations. Additionally, more detailed Cross-Cascades Corridor specific information, including model input assumptions and processing, model scenarios and outputs, can be found in the Cross-Cascades Corridor Model Development Documentation. [MD]

1 Setting up MEPLAN

1.1 License Information

WSDOT has obtained a single-site license with a renewable annual maintenance contract for the MEPLAN software from Marcial Echenique & Partners Ltd (ME&P) of Cambridge, England. The license agreement allows unlimited copies of the software for use at the WSDOT transportation Planning office site. Future interest in multiple site licenses would need to be addressed through further negotiations with ME&P.

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In order to run the MEPLAN software, a license, contained in the usk.dat file, is required to permit the file to run. This file must be placed in the installed program files, as follows: C:/MEPLAN/program/usk.dat

1.2 Installation of MEPLAN

MEPLAN software consists of 2 CDs, one is to install MEPLAN version 3.0, and a second is an upgrade to version 3.1. The following installation procedure should be followed. Note: It is assumed MEPLAN will be installed in "C:\MEPLAN" and that the E: drive is the CD ROM

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drive. If not, please replace "C:\MEPLAN" and/or "E:" with the appropriate path/drive in the following procedures:

Install MEPLAN 3.0

1. Load the MEPLAN 3.0 CD
2. Run "E:\MEPLAN30\INSTALL\setup.exe"
3. Follow instructions as prompted, installing to "C:\MEPLAN\"
4. Remove the MEPLAN 3.0 CD

Upgrade to MEPLAN

1. Load the MEPLAN 3.1 upgrade CD
2. Rename "C:\MEPLAN\PROGRAMS" to "C:\MEPLAN\PROG30".
3. Create a directory "C:\MEPLAN\PROGRAMS".
4. Copy all files from "E:\MEPLAN31\PROGRAMS" to "C:\MEPLAN\PROGRAMS"
5. Copy all files from "E:\MEPLAN31\UTIL" to "C:\MEPLAN\UTIL"
6. Rename "E:\MEPLAN\Blank\UTP.DAT" to "E:\MEPLAN\Blank\UTP30.DAT"
7. Copy all files from "E:\MEPLAN31\Blank" to "C:\MEPLAN\Blank"
8. Copy usk.dat licensing file to "C:\MEPLAN\PROGRAMS".

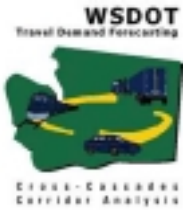
Other 3.1 upgrade information can be found in the following file on the MEPLAN 3.1 upgrade CD: E:\MEPLAN31\README31.txt

Other files that facilitate the running of MEPLAN include:

cdMEPLAN.bat – changes directory to MEPLAN application files, upon opening MSDOS command prompt. Locate file in root directory of MSDOS command prompt.
setpath.bat – adds MEPLAN program files location (C:/MEPLAN/) to the path, avoiding the need to specify the full path for each command. Locate file in root directory of MEPLAN application.

1.3 Basic System Requirements

The following basic system requirements were identified by Anthony Lau of ME&P, regarding a 100-zone MEPLAN system, with potential for doubling the number of zones. If a new machine will be purchased for running MEPLAN, a Pentium 4 1GHz machine, 512M Byte 133MHz RAM, 30G Hard Disk, running NT 4 is recommended, based on the UK market.



The WSDOT MEPLAN licensing agreement stipulates minimum computer requirements of a Pentium 200. An expanded discussion follows:

Computer - IBM PC or compatible.

Operating System - ME&P supports NT 3.51, NT 4, Win 95, but strongly recommends NT 4. MEPLAN been fully tested in Win 98, WinMe and Win2000.

Processor Speed - Processor speed and bus speed will affect the time required to run MEPLAN programs. MEPLAN does not have any further requirements on processor clock speed then the operating system the PC is using. However, the faster the clock speed, the faster MEPLAN can produce results.

RAM - The RAM requirements depends on the size of the model. 512M Byte of RAM will be sufficient for most models in the 100-200 zone size. Statistics show that if the RAM can only hold 90% of MEPLAN, the time required to run MEPLAN is increased by a factor of 3. If the amount of RAM is around 20% the size required by the model, a factor of 10 is not surprising. Since it is normal for a MEPLAN run may take a few hours to complete, such speed factors can be significant.

Disk Space- The MEPLAN package will require around 10M Byte of disk space to install. The disk space required by the model depends on the size of the model. A 100-zone model should fit comfortably in a 10G disk.

1.4 Installation of System Updates

Future MEPLAN upgrades will be made available from ME&P, while WSDOT maintains the annual maintenance contract on the MEPLAN software. It is assumed that future MEPLAN versions/upgrades would be installed similar to the MEPLAN v3.1 upgrade to v3.0, as discussed above under installation.

1.5 Relevant Supporting Software

In addition to the MEPLAN program software, an ASCII text editor and the use of ArcView (or Network Tool) facilitate the modeling process. Because MEPLAN uses ASCII text files with fixed columns, a text-editor with column-editing functions is very useful. UltraEdit 3.0 was used on the Cross-Cascades Corridor Analysis Project. Additionally, MEPLAN is set up to use Network Tool as its graphical interface. As requested by WSDOT, ArcView was employed in this project to view MEPLAN data, as discussed in the last section of this guide.

2 Basic Model Structure and Critical Files Used

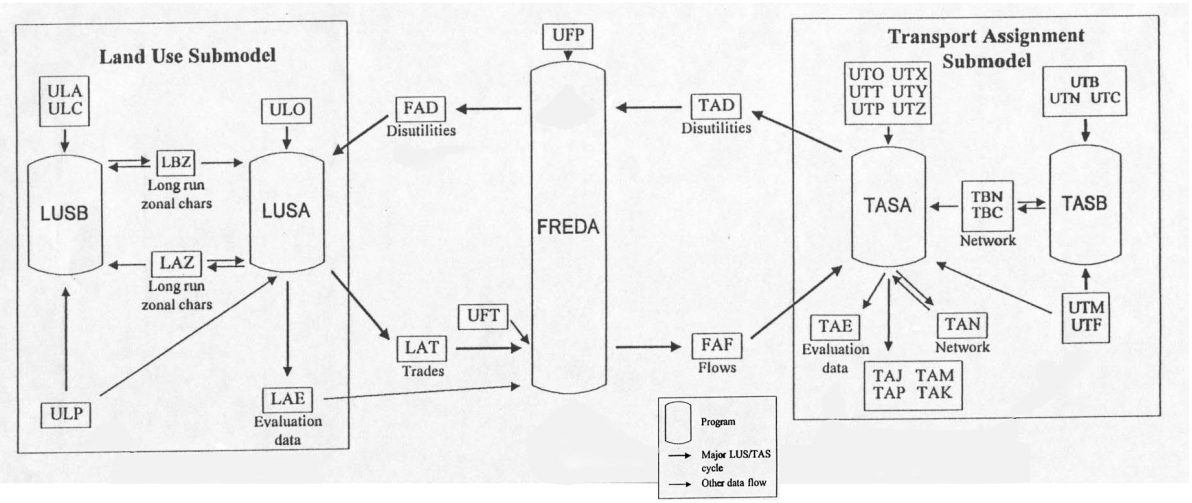
The process of the MEPLAN model is identified in Figure 1. This section discusses the files and directory needed to implement this process. Additionally, the MEPLAN programs, running the model, and MEPLAN output files are discussed. Where the Cross-Cascades Corridor Analysis Project has used MSExcel files to feed MEPLAN inputs or process MEPLAN outputs, these are discussed as well.

In general, MEPLAN files are named with a 3-character identifies. User input files (i.e., those not created by another MEPLAN program) begin with a "U". The second character specifies the submodel:

L – LUS, Land Use Submodel
F – FRED, Interface Submodel
T – TAS, Transport Submodel

MEPLAN output files begin with the letter of the submodel. The second letter is the last letter of the name of the program, which produced the file. In both input and output files, the final letter again is a somewhat mnemonic identifier for the file contents (e.g., 'c' for constraint or coordinates). All input and output MEPLAN files are ASCII .DAT format (no tabs). Each file is structured to include a header group, followed by one or more data groups in columns 2-72. Each group is separated by a single record composed of one space and 71 zeros. More detail regarding the standard layout of the file header can be found in MEPLAN User's Reference Manual. Although MEPLAN is set up to employ Network Tool 2.0 as a graphical interface, WSDOT chose to use ArcView instead. The ArcView output interface is discussed in the next section.

Figure 1 MEPLAN Flow Chart



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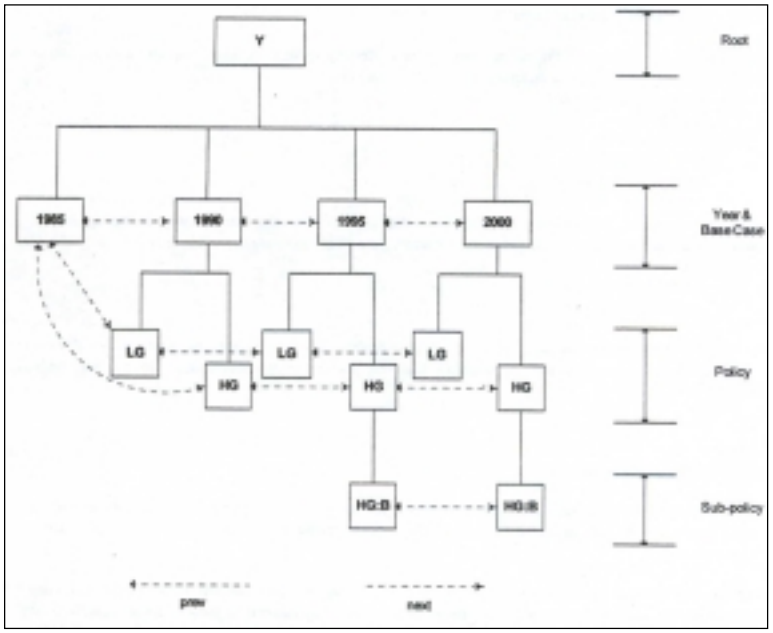
2.1 Directory Structure

MEPLAN programs and utilities are designed for use within a directory structure form, as shown in Figure 2. Figure 3 gives the structure used in the Cross-Cascades Corridor Analysis project.

Figure 2 MEPLAN Directory Structure



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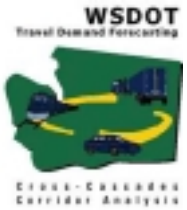
If a file does not exist in a directory, the "nearest" occurrence above that directory is used. For example, a file of vehicle occupancies that applies to all years would be saved in the root directory. If occupancies changed in a future year, a separate file could be kept in these year-by-year directories. Although allowed by the operating system, MEPLAN file names and directory names cannot contain spaces or '&'.

To facilitate running through time, MEPLAN relies on the following files in each directory to facilitate movement between time period directories.

cd_next.bat – User created (or created using MEPLAN program, see [UG1]) file that changes to the next time period directory. Resides in all but the last year directory of each policy.

cd_prev.bat – User created (or created using MEPLAN program, see [UG1]) file that changes to the previous time period directory. Resides in all but the earliest (baseyear less one time period) year directory of each policy.

Figure 3 Cross-Cascades Corridor Analysis Project MEPLAN Directory Structure



2.2 MEPLAN Input Files

Key input files used in the Cross-Cascades Corridor MEPLAN model are listed in Figure 4. Groups within the file are specified parenthetically (e.g., UFP group 2 is UFP[2]). Although other MEPLAN files exist, these are the key files for running the Cross-Cascades Corridor model, as applied in this project. These files are also shown, with their linkages to the model structure, in the Figure 1 MEPLAN flow chart.

The following MEPLAN program is useful to create template files with the correct column and group format:

new_file *XXX.dat* – MEPLAN program that creates in the current directory an empty MEPLAN file with correct formatting of the user-specified filename included on the command line (*XXX.dat*).

copy_file *XXX.dat* – MEPLAN program that copies in the current directory the version of the file *XXX.dat* found in the nearest location higher up in the directory structure . If no file is found, a blank file is created (as in the new_file command)

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Figure 4 Key Cross-Cascades Corridor Analysis Project MEPLAN Input Files

Key Cross-Cascades Corridor MEPLAN Input Files:

UFP[1]	FREDA Run Control Options (for output, number of iterations, etc.)
UFP[2]	Land Use Model (yearly) to Transport Model (daily) Time conversion
UFP[4-5]	Trip Generation rates per industry employee or household
ULC[1]	Baseyear (and future year, if imposed) Demographic constraints
ULC[2]	Baseyear (and future year, if imposed) Exogenous Production by zone
ULC[3]	Study-wide Exogenous Production Growth by factor
ULP[1]	Factor Definitions and Units
ULP[2]	Zone Definitions (including identification of external zones)
ULP[3]	MEPLAN Economic Coefficients by factor
UTB[1]	Coded Transport Link Units & and conversions
UTB[2]	Automatically generated Interchanges (e.g. Transit Wait links)
UTC[1]	Node Type Definition
UTC[2]	Node Coordinates
UTF[1]	Flow Type Definition and Flow Units
UTF[3]	User Mode Definitions and allowable states
UTF[4]	Vehicle Load Factors (e.g., tons/vehicle, auto occupancy)
UTF[5]	Mode Split Utility Function Structure
UTF[6]	Link Cost Functions (applied to UTN[1] values)
UTF[7]	Mode Split Disutility Functions
UTF[9]	Path Choice Parameters
UTF[10]	Mode Split Utility coefficients
UTM[1]	Transport States Definition (MEPLAN refers to these as "Network Modes")
UTM[2]	Link Type Definition (including units and modal usage)
UTM[4]	Equivalent Vehicle Ratios
UTM[5]	Network Cost Functions
UTN[1]	Network Links
UTN[2]	Future Network Link Additions/Deletions/Modifications
UTN[3]	Transport Services that operate on base transport networks
UTN[4]	Intrazonal paths
UTO[1-7]	Run Control Options (e.g. iterations, output information, etc.)
UTP[1]	Capacity Restraint Function

2.3 Model Input File Selection and Description

Figure 5 lists MSExcel files that were developed by the Cross-Cascades Corridor Analysis Project to facilitate development of specific MEPLAN input files. Each spreadsheet has a worksheet which matches the columns of the associated MEPLAN input file. These single worksheets can be saved in space-delimited text format and cut-and-pasted into the MEPLAN input files using a text editor. A more detailed discussion of the file contents and processing done within these excel files can be found in the Cross-Cascades Corridor Model Development Documentation. [2]

Figure 5 Cross-Cascades Corridor MSExcel Files used in Generating MEPLAN Input Files

Land Use Model:			
IO Processing.23mar01.xls	MEPLAN Coefficients	ULP[1]	
	Future Year Exogenous Growth	ULP[3]	
Demog By Zone.ULC.xls	Baseyear Employee/Household constraint		ULC[1]
	Baseyear Exogenous Production allocation	ULC[2]	
Interface Model:			
UFP trip rates.xls	Trip Rates per factor	UFP[4]	
Transport Model:			
ExtTruckOD.xls	External Truck Trips	UFT[2] &ULC[1] imports	
Highway Network 5-15-01.xls	Highway network links/nodes	UTN[1]	
Rail Network 5-15-01.xls	Railway network links/nodes	UTN[1]	
AirNetwork.xls	Airways network links/nodes	UTN[1]	
Link-Node Definitions-UTB.xls	Network units and numbering convention	UTB[1]	
Pub Transit Svc.utn.xls	Public Transit Services (air, Amtrak, coach)	UTN[2]	
Cost Functions.xls	Fares, Rates, Value of time for all modes	UTM[5], UTF[4, 6-8]	
UTF FuperMU.xls	Vehicle loads and occupancies	UTF[4]	

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2.4 MEPLAN Programs

Five program modules, as shown in Figure 1, comprise the core of the MEPLAN model: LUSA and LUSB for land use, TASA and TASB for transport, and FRED for interface. LUSB and TASB are largely pre-processors to LUSA and TASA, respectively. The remaining four program modules form the core processing loop. LUSA iterates on locating factors to meet MEPLAN economic coefficients and constraints. FREDA converts these spatially located activities to trips. TASA stochastically assigns these flows to modes and paths. FREDA converts the resulting travel disutilities/costs for use in LUSA land use choice for the following period. Linkages to previous time periods by the LUS modules create a cyclical spiral through time. A summary of the function of these modules are listed below, while significantly more detail is provided in the MEPLAN User's Reference Manual. The files that are exchanged between these core model components are listed in Figure 6.

LUSA – Generates and locates the production of factors for which supply and demand reach equilibrium during a time period, and thus establishes the pattern of prices and trades within the study area. Total demand generated is determined by the initial level of exogenous demand (exogenous production and consumption) and demand functions specified, while location is influenced by zonal constraints and production attractors, and disutilities of travel (calculated in the transport model).

LUSB – Allocates exogenously determined study-wide changes in zonal characteristics, and calculates production attractors (for use in the interface model). A set of user-defined functions is used to distribute changes between zones, and calculates the production attractors.

TASA – Performs modal split and assignment of flows to paths within the transport network, and thus determines the costs and times of trips by mode (including congestion effects) that these flows imply.

TASB – Checks a network description, and performs selected conversion operations on the link characteristics coded (e.g., convert speeds into times), and expands transit links.

FRED – Converts trade volumes to flow volumes, and disutilities of travel per flow unit to disutilities per trade unit. In the opposite direction, it calculates back-flows due to returning empty freight.

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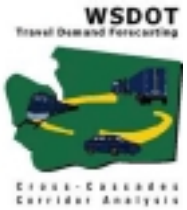

Figure 6 MEPLAN Core Model Files

TAD	Transport Disutilities
FAD	Trade Disutilities and costs
LAT	Trade Volumes
FAF	Flow Volumes
LAZ	Trade Activity (employment/Household) by zone
LBZ	Long Run Trade Characteristics
TBN/TBC	Processed MEPLAN Transport Network and Nodes

2.5 Running MEPLAN

MEPLAN is run out of MSDOS, or from the File Manager "run" or Windows 95/NT4.0 start menu "run" command. The command line is entered exactly as for DOS. The key programs and their order of execution follow. Additional run options, other than the log file option shown below, are specified in the MEPLAN User's Reference Manual:

Run lusb /log:lbl.dat
Run lusa /log:lal.dat (may run several times until converges)
Run Freda /log:fal.dat
Run tasb /log:tbl.dat
Run tasa /log:tal.dat
Run Freda /log:fal.dat

After running these programs, the log files should be checked to ensure that all files were read correctly and no fatal errors were encountered.

Several MEPLAN programs must access output files from the previous period, including:

for LBZ, LAZ files when running LUSB
for FAD files when running LUSA
for TBN and TBC files when running TASB
if no current year LAZ file when running LUSA
if no current year TAN file when running TASA

Thus, a directory must be made for a year one period prior to the baseyear (e.g., 1995 for the Cross-Cascades Corridor Analysis model with baseyear 1998 and 3-year period). This directory would contain a copy of the baseyear FAD and blank copies of LBZ, LAZ, TBN, and TBC files.

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A run of the model will consist of running the above commands for each year (single directory, drawing from previous year), moving to the next year, repeating these commands, etc., until the final year is reached. (no cd_next.bat in final year). A sample run is shown in the MEPLAN User's Reference Manual. MEPLAN error outputs, listed by number, are documented in the last section of the MEPLAN User's Reference Manual.

Initially, in building a MEPLAN model, the focus is on the base year. It is important to achieve convergence on all factors when running LUSA. This means that a set of economic flows were set up that satisfy both the MEPLAN coefficients and baseyear demographic constraints for each zone. Convergence can be identified by reviewing the LUSA log file (lal.dat). This may take several hundred iterations of LUSA. Once convergence is reached, the other MEPLAN programs should be run for the baseyear and the baseyear FAD.dat file copied to the directory one period prior to the baseyear, and convergence achieved again. This ensures that the transport disutilities/costs reflect the loads imposed by the baseyear economic activity. Once LUSA convergence is reached, the model can be run using the above-mentioned commands.

The following batch files facilitate the process of running MEPLAN through all time periods:

run_year.bat – User created file that runs all MEPLAN programs for single year, containing the program lines listed above. This file resides in the base MEPLAN directory (not in a year directory) and is called from any year/policy directory.

run_pol.bat – User created file that runs all MEPLAN programs for all years. This program resides in the base directory and is called from the baseyear directory. It concludes in the last year directory (assumes no cd_next.bat file in last year). For future policy actions, the program is called from the directory of the first year for that policy and concludes in the last year directory for that policy.

2.6 MEPLAN Output

Once MEPLAN has been run for a year or multiple years, the output files shown in Figure 7 will be created in each year directory. MEPLAN will only output some files or selected data, as specified in the UTO.dat file for transport and ULO.dat file for land use. Log files must be specified in the command line or they will be echoed to the screen instead. Additionally, the MEPLAN evaluation submodel, as shown in Figure 1, was not used in the Cross-Cascades Corridor model development. It may be useful in future model development and scenario analysis. Additionally, MEPLAN is set up to use Network Tool 2.0 as a graphical interface. However, WSDOT chose to use ArcView instead.

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Figure 7 Cross-Cascades Corridor Key MEPLAN Output Files

- Land Use Model
  - LAZ, LBZ – Zone trade characteristics
  - LAT O-D Trade Activity (Employment/Households) by zone
  - LAE –Portion of Trades consumed by each zone
  - LAL and LBL - Log files for LUSA and LUSB
- Interface Model
  - FAD – O-D disutilities/costs of trading each factor
  - FAF – O-D flow volumes, required by Transport Model
  - FAE – Trips by Purpose
  - FAL – Log files for FRED
- Transport Model
  - TBN/TBC– MEPLAN processed network
  - TAD – O-D transport flow attributes, required by Interface Model
  - TAN – Network vehicle volumes (including externals) and travel times
  - TAP - Minimum paths by mode and O-D pair and their attributes
  - TAM - O-D Travel time, costs, traffic loads by flow and mode
  - TAK - Screenline Analysis (for links specified in UTO.dat)
  - TAJ/TAM/TAP/TAK – various transport/network data
  - TAE – Summary VMT by linktype, Transport costs by flow/mode, mode split
  - TAL and TBL – Log files for TASA and TASb

The following MEPLAN command is useful in formatting output for use in other programs:

table *XXX.dat* - This MEPLAN program produces a comma delimited file of MEPLAN input or output files (*XXX.dat*), suitable for reading into a database, MSExcel or other external program. The program results in XXX#.CSV files (comma separated variable, or .TXT if another separator is chosen), one for each file group (#) of the file included in the command line (*XXX.dat*). Leading blank columns are replaced with the text of the previous line.

Critical Files Used

Additionally, the following MSExcel files have been developed by the Cross-Cascades Corridor Analysis Project team to assist in processing MEPLAN output. They typically require the user to paste the latest MEPLAN output file of the specified type into an MSExcel file:

Shortest Paths.TAP.xls - This file displays the linktypes used in the shortest paths generated by the model for user-specified O-D pairs and modes. It relies on Model output file TAP.dat. This information is used in model calibration to check that the model is correctly generating paths that utilize the correct link types.

Instructions: Identify the destination zone of interest and specify these zones in UTO[2] before running the model for the scenario of interest (currently set to zone 26=Seattle Downtown). Convert output TAP.dat file to TAP1.csv using MEPLAN "table" command (typically 1998 baseline). Copy TAP1.csv data into the appropriately identified location in the "TAP1.csv" worksheet in the file. The user must then define the destination node in cell J17 (must be output in the TAP.dat file, as specified in UTO[2]); and ensure that the formulas in columns A-H, N-P, AB-AD are copied down to the end of the TAN1.csv data. The "routes" worksheet will be generated automatically and plots the linktype used against the O-D trip distance, in reverse order (origin on right). Within the "routes" worksheet, the user can modify the yellow highlighted cells to modify the origin zone, the user mode, or the flow type to check the various shortest path routes generated by the model.

Mode Sensitivity.TAM.xls - This file displays the mode split for various distances (or other XXX.dat parameters) by flow. It relies on the MEPLAN XXX.dat output, with a series of representative O-D pairs as specified in UTO[4]. This information is useful in identifying the model's mode shift sensitivity. For example, how does rail mode split change with O-D distance, cost, or disutility.

Instructions: Convert TAM.dat to TAM1csv using MEPLAN "table" command the scenario of interest. Copy TAM1.csv data into the appropriate worksheets in the file ("TAM1.csv"). The user must then extend the formulas in columns A and M-R to the final row of the TAM1.csv data. Then the file will automatically generate the "Plot" and associated "Data Table" worksheet. The plot shows the number of trips of each mode made in each O-D distance bar. The "Data Table" worksheet is a pivot table representation of the same data. Within either "Plot" or "Data Table" worksheet, the user can, using the pull down menus, alter the O-D pair and/or the flow being displayed.

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Critical Files Used

ZonePairODCharts.xls - This file displays the distance distribution of trips (by mode) of a particular flow that originate from the user-specified zone. It relies on the MEPLAN TAM.dat output, with a series of representative O-D pairs as specified in UTO[4]. This is useful in identifying the model's assumed trip length distributions and their variation by trip purpose and user mode.

Instructions: Convert TAM.dat to TAM1csv using MEPLAN "table" command as the scenario of interest. Copy TAM1.csv data into the appropriate worksheets in the file ("TAM1.csv"). The user must then update the named range "DesFlOrg" and extend the formulas in columns A and M to the final row of the TAM1.csv data. Then the file will automatically generate the "Plots" worksheet to show how mode split varies with distance. Within the "plots" worksheet, the user can modify the red cells to alter the x-axis metric (distance, time, etc.) and the flow being displayed, to check how mode sensitivity varies by trip purpose.

Demog thru Time.LAZ.xls - This file summarizes the baseyear (1998) and future year (1998-2019) growth of households and employment as allocated by the model. The file creates a DBF file that can input into ArcView to graphically display the household and employment data by zone for these years. For ease of use, the 15 factors are summarized into 5 employment and 4 household income group subcategories as well as in total.

Instructions: Convert LAZ.dat to LAZ1.csv for 1998 and the scenarios of interest in 2019, using the MEPLAN "table" command. Copy the LAZ1.csv data into the appropriate worksheets in the file ("1998 LAZ1.csv" and "2019 LAZ1.csv". Each 2019 scenario LAZ1.csv file needs to be copied into the "2019 LAZ1.csv" worksheet, with the blue fields, further copied (values) to the appropriate "Scen x data" worksheet. The file will automatically generate the "create DBF file" worksheet, with absolute values of the factor, as well as growth relative to the 1998 baseline for each scenario. Within the "create DBF file" worksheet, the user can modify the red text to reflect the subcategory (or total) of interest. The DBF files, for use in ArcView, are generated using the macro "create DBF". The use of these files in ArcView is described under ArcView.

Cross-Cascades Corridor Links.TAN.xls – This file summarizes the loaded transport links for the multiple modes in the Cross-Cascades corridor. It relies on the MEPLAN TAN output. This information is used to: (1) compare SR2 and I-90 tables

of volumes with WSDOT Travel Delay Methodology-based volumes for 1998 and 2022; (2) summarize rail (Amtrak and Freight) and Air volumes by link within the corridor; and (3) display plots of SR2 and I-90 volumes and volume/capacity ratios across distance for 1998 and 2019.

Instructions: Convert TAN.dat to TAN1.csv using the MEPLAN "table" command for 1998 and 2019 scenario of interest. Copy TAN1.csv data into the appropriate worksheets in the file ("1998 TAN1.csv" and "2019 TAN1.csv"). The file will automatically generate the "Link Volumes" and "Plots" worksheets.

Cross-Cascades Corridor Mode Split.TAK.xls -_This file summarizes the passenger and freight mode split at 3 screenlines along the Cross-Cascades corridor. It relies on the MEPLAN TAK output, with a pre-specified series of representative O-D pairs as defined in UTO[5]. This information is used to summarize mode split for passenger and freight by state (network mode) at three corridor locations: just east of Seattle, at the Columbia/Snake River crossing, and just west of Spokane.
Instructions: Copy TAK1.csv data for the 1998 and 2019 scenarios of interest into the appropriate worksheets in the file ("1998 TAK.dat" and "2019 S# TAK.dat"). Note that all TAK screenline groups reside on each TAK.dat worksheet. Once the TAK.dat files are copied over, the MSExcel Data-"text to columns" command (fixed format) is used on each to convert it into multiple columns, beginning in Column A. The file will automatically generate the "Mode Split" worksheet mode split table and plots. Note: the worksheet formulas assume that the TAK.dat files be specified (in UTO[5]) with the same number of links per screenline. If this is changed, the formulas will need to be updated.

2.7 Model Edit /Update Examples

The following examples provide the user with basic instructions for implementing sample updates to the model data and/or model structure. The reader is also referred to the MD documentation details regarding implementation of the four Cross-Cascades Corridor Analysis Project validation scenarios:

Modify Transport Networks for Existing Modes – MEPLAN transport network data are embodied in the UTN (links) and UTC (nodes) files. Changes or expansion to the existing physical networks (airways, railways, roadways) would be included in

the UTN[1-2] and UTC[2] files. Changes to passenger services (coach, Amtrak, air passenger) on the existing networks, including service frequency changes or new routes, would be input in UTN[3]. The appropriate link/node attributes (node latitude/longitude, link length, speed, capacity, service headway and vehicle capacity) would be required for each new/modified link or service, with units and conversions in UTB[1]. It is recommended that any changes to existing networks be made in the associated MSExcel file, and used to update the associated MEPLAN input files. This includes the following files: "Highway Network 5-15-01.xls," "Rail Network 5-15-01.xls," "AirNetwork.xls," and "Pub Transit Svc.utn.xls."

Add User Modes – The development of a new mode requires that a transport network, as well as associated mode attributes and costs. The new mode can operate on existing or newly defined network, states, and links. The new mode is defined in UTF[3] with the allowable states that the mode can use. If new link types and states are necessary, they are defined in UTM[1-2]. If a new transport network is required, it is defined in UTC (nodes) and UTN(links), including appropriate centroid connectors. New services (on new or existing links) are defined in UTN[3]. Cost functions for the new mode reside in UTF[4,6-8], and UTM[5]. "Cost Functions.xls" can be helpful in correctly defining the various cost components. Finally, vehicle load factors (UTF[4] and associated "UTF FUperMU.xls"), Equivalent Vehicle Ratios (UTM[4]) and capacity restraint functions (UTP[1]) may also need to be defined.

Modify Zones– Zones are defined in the ULP file, and connected to the transport network in UTC and UTN. The ULP[2] field gives the zone name and identifies it as an internal or external zone. UTC defines the coordinates of the centroid, and UTN defines centroid connectors for the various modes. As set-up, each centroid requires the following links: two 1-way links of type 10 for truck terminal access, a 2-way link of type 1 for other road connections, and for external zones a 2-way link of types 4 and 12 to the new external zone airport. Other data, defined by zone that would also need to be reviewed/updated includes:

- The current Cross-Cascades Corridor model includes the transport network nodes containing the node in the node number. This numbering system is set in the UTC[1] node definition and is reflected in the transport network links defined in UTN[1-4].
- Demographic (factor) constraints and exogenous production by zone in ULC.
- MEPLAN economic coefficients, if specified by zone, in ULP[3].

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Constrain Future Year Demographics by Zone – The Cross-Cascades Corridor model currently only constrains the statewide growth in future years via the ULC[3] file. If more detailed zone level constraints are desired (e.g., per GMA), they would be defined in ULC[1] and match study-wide growth in ULC[3], for each future year (or future year scenario). The "Demog by Zone.ULC.xls" file may be useful in generating zone-level constraints from county-level data, as done for the baseyear constraints (ULC[1]).

Update to 2000 US Census Data – U.S. Census data is used to sub-divide county-level baseyear demographic data (ULC[1]) and allocate baseyear exogenous production by zone (ULC[2]). The worksheet "TAZ summaries 1990" in file "WA90censustract.xls" contains household, employment, "not in work force" data, among other 1990 census data by Washington State census track, the other sheets in the file identify the tracts included in each Cross-Cascades Corridor zone. The worksheet "HH by income 90" in file "HHInc90Census.xls" contains 1990 census income data (except King County which was from obtained directly from PSRC). These two files would be modified to reflect Year 2000 census data. By editing these files while the linked file "Demog by Zone.ULC.dat" is also open, the "ULC[1] Baseyear" and "ULC[2]" worksheets in the latter file will be updated automatically. The updated data can be copied to the MEPLAN ULC.dat file.

3 ArcView Interface

WSDOT selected ArcView as the graphical interface for the project. Network Tools is an alternative software package that is recommended to facilitate interface with MEPLAN input and output files. ArcView Avenue script has been written to enable a 1-way interface to view selected MEPLAN files. These include the input and output network and zone data, as discussed below. Additionally, several related ArcView Shape files have been included in the Cross-Cascades Corridor fileset to provide context for the MEPLAN data.

All but the Cross-Cascades Corridor TAZ zones were provided by WSDOT:

WA Coast/Rivers	Coast.shp/.shx/.dbf
WA Urban Areas	City.shp/.shx/.dbf
WA Borders	Washborders.shp/.shx/.dbf
WA Rail	Washborders.shp/.shx/.dbf
WA SR2	rte-2.shp/.shx/.dbf
WA I-90	i-90.shp/.shx/.dbf
WA HSS	Hsssrfy.shp/.shx/.dbf
WA State Highways	Statehighways.shp/.shx/.dbf
CCC Internal TAZs	Tazs2-23-01.shp/.shx/.dbf

3.1 Viewing Network Data

A special tool was created for use in the conversion of MEPLAN network files into a useable format for viewing and manipulation in ArcView. The tool was created for ArcView 3.x and written in Avenue. The file containing the ArcView tool is titled "*MEPLAN-Data.avx*".

Installation:

Find the drive where ArcView files are stored in your computer.
Note: It is assumed that ArcView is installed in the C: drive. If not, please replace "C:\ " with the appropriate path/drive in the following procedures:

1. Move the "*MEPLAN-Data.avx*" file into the folder: <<C:\ESRI\AV_GIS30\ARCVIEW\EXT32>>.
2. Open ArcView
3. Before opening a Project click on the "File" button in the bar at the top of the screen and scroll to "Extensions". When you click on "Extensions" and "Extensions" dialog box will appear.
4. Scroll down the list of available options until you come to the extension "MEPLAN-data Tools".
5. If the box to the left of the "MEPLAN-data Tools" extension name is not checked then click on it. If it is checked then leave it checked.
6. Close the dialog box.

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ArcView Interface

To Run the MEPLAN Network Conversion Tools:

1. Open ArcView
2. Open your ArcView Project
3. There should be a pull-down menu at the top of the screen labeled "MEPLAN-Data". If no such menu is present then repeat the component of the installation process that is performed after ArcView is opened.
4. Click on the "MEPLAN-Data" label.
5. Choose "Input Network" if you would like to create a theme for the UTN.dat and UTC.dat files which contain the user-created MEPLAN network. Field headers match the definitions from the UTN[1] input file.
6. Choose "Loaded Network" if you would like to create a theme for the TAN.dat and TBC.dat or the TBN.dat and TBC.dat files, which contain MEPLAN's loaded network data (and associated attributes of volume, travel time, etc.). Field headers match the definitions from the TAN[1] input file. Note: Unlike the MEPLAN input network, this network contains the passenger services networks. Also, because MEPLAN rounds the coordinates of the nodes in TBC, this theme will not exactly match the MEPLAN input network theme.
7. Once you have made a choice, you will be prompted for the location of the files you would like to visualize (typically in your C:\MEPLAN\year\policy directories). You will then be allowed to choose to which view to add the new theme.
8. Once the data are moved into a theme, they may be viewed in a variety of ways that may be identified by the user. The ArcView manual contains descriptions of various processes by which to view the complete range of MEPLAN network attributes that will be associated with each theme. For example, the following conversion has been used to extract a shape file (.shp) that includes only the internal roads from the full network:
    - Go to the view and select the UTN/TAN/TBN theme
    - Query the theme to select only the external links:
      ([Orignode] >= 55) or ([Destnode] >= 55)
    - Open the table for the original theme
    - Inverse the theme selection (now selection includes all internal links)
    - Query the theme to select, from within the first selection, the road links:
      ([Type] = 2) or ([Type] = -2) or ([Type] = 3) or ([Type] = -3)
    - Create a new theme from the selected set, using Theme-convert to a shape file. Inserted the new internal roadway theme into current view
    - Select the new theme and rename it using Theme-Properties

3.2 Viewing Zone Data

Zone attribute data can be plotted by joining a DBF file of data to the TAZ zone shape file. The .DBF file must be in the format where each row represents a zone, one column with the zone numbers, and additional columns of zone data. For example, the user could generate DBF files of the model's allocation of zone households and employment, using the "Demog thru time.LAZ.dat" excel file (as discussed above under output analyses). The processing of creating a new theme from DBF files is follows:

1. Open ArcView
2. Open your ArcView Project
3. Add a theme using the file: "tazs2-23-01.shp"
4. Create a table of the TAZ zones from a view that will eventually display the zone data.
5. Add the DBF file as a new table in ArcView
6. Join the DBF table with the existing TAZ zone table by the zone number column. Elect to add this theme to the current view.
7. Once the data are moved into a theme, they may be viewed in a variety of ways that may be identified by the user. The ArcView manual contains descriptions of various processes by which to view the complete range of MEPLAN network attributes that will be associated with each theme.

References

[UG1] MEPLAN User's Reference Manual, v3.1 ME&P, Cambridge, England (2000)
[MD] Cross-Cascades Corridor Model Development Documentation, WSDOT Transportation Planning Office (June 2001)

Figure 8 Basic Cross-Cascades Corridor MEPLAN Definitions

ULP[1] FACTOR DEFINITIONS

FactFactName		FactUnit	T
1	Ag,Fstry	Employee	X
2	Mining	Employee	X
3	Constructn	Employee	
4	Manufactng	Employee	X
5	TCPU	Employee	X
6	Whol Trade	Employee	X
7	Ret Trade	Employee	X
8	FIRE	Employee	X
9	Services	Employee	X
10	Govnmnt	Employee	X
11	HHInc1	Household	X
12	HHInc2	Household	X
13	HHInc3	Household	X
14	HHInc4	Household	X
15	Imports	$M	X
16	SocialRec	Trips	X

UTF[1] FLOW DEFINITIONS ("FLOWS")

Flow	FlowName	FlowUnit
1	Commuting	PersTrips
2	Shopping	PersTrips
3	Recreation	PersTrips
4	VFR	PersTrips
5	Low VTW	Tons
6	Mid VTW	Tons
7	High VTW	Tons
8	Services	PersTrips
9	BizPromote	PersTrips
10	ExtIntTrck	Tons
11	ExtExtTuck	Tons

UTF[3] USER MODE DEFINITIONS ("MODES")

UsMd	UsMdName	NtwkModes (states)
1	PrivAuto	1
2	WorkAuto	2
3	MediumTrck	8 12
4	HeavyTrck	9 13
5	CoachPass	3 4 7
6	RailPass	1 5 7
7	RailFrt	2 10 14
8	AirPass	1 6 7
9	AirFrt	2 11 15

UTM[1] NTWK MODE DEFINITIONS ("STATES")

Mode	ModeName	ModalUnit
1	PrivDrive	Vehicles
2	WorkDrive	Vehicles
3	RideCoach	Passengers
4	ImplctCoch	PCUs
5	RideRail	Passengers
6	RideAir	Passengers
7	AccessEgrs	Passengers
8	OnMedTruck	Vehicles
9	OnHvyTruck	Vehicles
10	OnTrain	RailCars
11	OnAirplane	Tons
12	MedTerminl	Vehicles
13	HvyTerminl	Vehicles
14	RailTermnl	Vehicles
15	AirTerminl	Vehicles

UTM[2] LINK TYPE DEFINITIONS ("LINKS")

Type	TypeName	CapUnit	NtwkModes (states)					
1	RoadConx	Cars/day	1	2	4			
2	RdOther	Cars/day	1	2	-3	4	8	9
3	RdInterst	Cars/day	1	2	-3	4	8	9
4	RdStaConx	veh/day	1					
5	Railways	veh/day	-5	10				
6	Airways	veh/day	-6	11				
7	Coach	pers/day	3					
8	Amtrak	pers/day	5					
9	AirPassSrv	pers/day	6					
10	TruckTerm	none	12	13				
11	RailFrTerm	none	14					
12	AirFrTerm	none	15					
14	Alight	none	7					
15	Wait	none	7					

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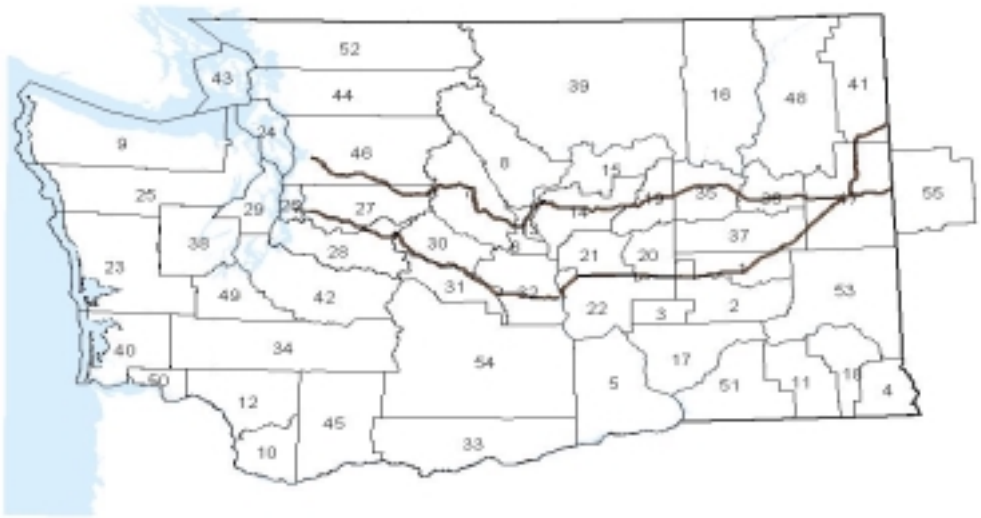
Figure 9 Cross-Cascades Corridor Zones and Centroids

Zone No.	State	County	Zone/MCD Name	Centroid
1	WA	Adams	Ritzville	Ritzville
2	WA	Adams	Lind/Washtucna	Lind
3	WA	Adams	Othello	Othello
4	WA	Asotin	Asotin	Clarkston
5	WA	Benton	Benton	Kennewick
6	WA	Chelan	Wenatchee	Wenatchee
7	WA	Chelan	Leavenworth	Leavenworth
8	WA	Chelan	Chelan	Chelan
9	WA	Clallam	Clallam	Port Angeles
10	WA	Clark	Clark	Vancouver
11	WA	Columbia	Columbia	Dayton
12	WA	Cowlitz	Cowlitz	Longview
13	WA	Douglas	E. Wenatchee	East Wenatchee
14	WA	Douglas	Waterville	Waterville
15	WA	Douglas	Bridgeport	Mansfield
16	WA	Ferry	Ferry	Republic
17	WA	Franklin	Franklin	Pasco
18	WA	Garfield	Garfield	Pomeroy
19	WA	Grant	Grand Coulee	Grand Coulee
20	WA	Grant	Moses Lake	Moses Lake
21	WA	Grant	Ephrata	Ephrata
22	WA	Grant	George/Warden	George
23	WA	Grays Harl	Grays Harbor	Aberdeen
24	WA	Island	Island	Oak Harbor
25	WA	Jefferson	Jefferson	Port Townsend
26	WA	King	Seattle-Shoreline	Seattle (CBD)
27	WA	King	East King	Bellevue
28	WA	King	South King	Sea-Tac Airport
29	WA	Kitsap	Kitsap	Bremerton
30	WA	Kittitas	Cle Elum	Cle Elum
31	WA	Kittitas	Ellensburg	Ellensburg
32	WA	Kittitas	Kittitas	Kittitas
33	WA	Klickitat	Klickitat	Goldendale
34	WA	Lewis	Lewis	Centralia
35	WA	Lincoln	Wilbur	Wilbur
36	WA	Lincoln	Davenport	Davenport
37	WA	Lincoln	Odessa	Odessa
38	WA	Mason	Mason	Shelton
39	WA	Okanogan	Okanogan	Okanogan
40	WA	Pacific	Pacific	South Bend
41	WA	Pend Oreil	Pend Oreille	Newport
42	WA	Pierce	Pierce	Tacoma
43	WA	San Juan	San Juan	Friday Harbor
44	WA	Skagit	Skagit	Mt. Vernon
45	WA	Skamania	Skamania	Stevenson
46	WA	Snohomish	Snohomish	Everett
47	WA	Spokane	Spokane	Spokane
48	WA	Stevens	Stevens	Chewelah
49	WA	Thurston	Thurston	Olympia
50	WA	Wahkiakur	Wahkiakum	Cathlament
51	WA	Walla Wal	Walla Walla	Walla Walla
52	WA	Whatcom	Whatcom	Bellingham
53	WA	Whitman	Whitman	Pullman
54	WA	Yakima	Yakima	Yakima
55	ID	Kootenai	Kootenai	Coeur de'Alene
56	EX	Vancouver BC		Vancouver BC
57	EX	Fernie BC		Fernie BC
58	EX	Minneapolis, MN		Minneapolis, MN
59	EX	Dallas, TX		Dallas, TX
60	EX	Sacremento, CA		Sacremento, CA
61	EX	Tokyo, Japan		Tokyo, Japan

Figure 10 Numbered Cross-Cascades Corridor Zones



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